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RESEARCH INSTITUTE FOR SAFETY

Impact of Safety Climate on Lone and Remote Workers



NTSB Public Forum
September 10-11, 2013

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generating knowledge to help people live safer and more secure lives



Mission:

To advance scientific, business-relevant knowledge in workplace and highway safety, and work disability



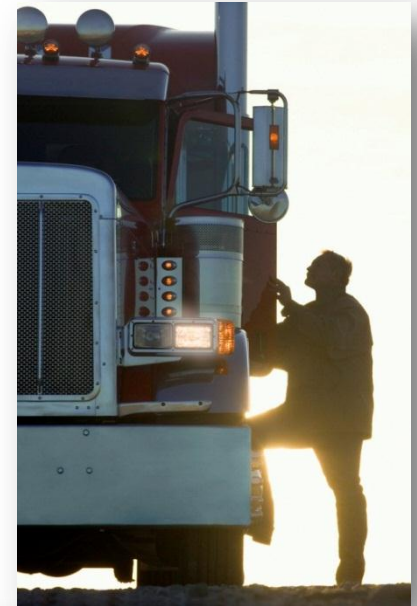
Catastrophic STS Failures - Lessons



- Weak management of manning levels, workload, shiftwork, often due to downsizing
- Inadequate training
- Lack of communication
- **Poor safety culture**, morale
- Human-system interface deficiencies
 - Over/under-reliance on automation
 - Information overload
- Inadequate knowledge about system state in relation to safety boundaries
 - Safety Management Systems, metrics, oversight
- Inadequate internal systems model

Research Objectives

- Understand the existence/formation of safety climate in [lone and remote workers](#), and its impact on safety behaviors and outcomes
- Develop valid and reliable safety climate scales for
 - Trucking industry
 - Utility/electric industry
- Test the validity of the generic SC scale for lone/remote workers



Unique Strengths

- Industry-specific content
 - focusing on competing demands (context-dependent) specific to industry sector, but including generic scale items
- Multi-level approach
 - Surveyed employees' perceptions of safety priorities of immediate supervisors (Group level) as well as top managers (Company level)
- Surveyed employees and supervisors
- Large sample sizes across multiple companies
- Collected both subjective and objective safety data
- Confirmed reliability and validity
 - Scale psychometric development was highly rigorous

Reliability and Validity

- Content Validity (Expert Panel)
- Exploratory Factor Analysis
- Cronbach's Alpha Reliability (coefficient of internal consistency)
- Confirmatory Factor Analysis
 - Fit Indices Confirm Structure
- Criteria Related Validity
 - Subjective Behavior Ratings
 - Objective Individual/Group Safety Scores
 - DOT Company Level Safety Scores (trucking)

SC in the Trucking Industry

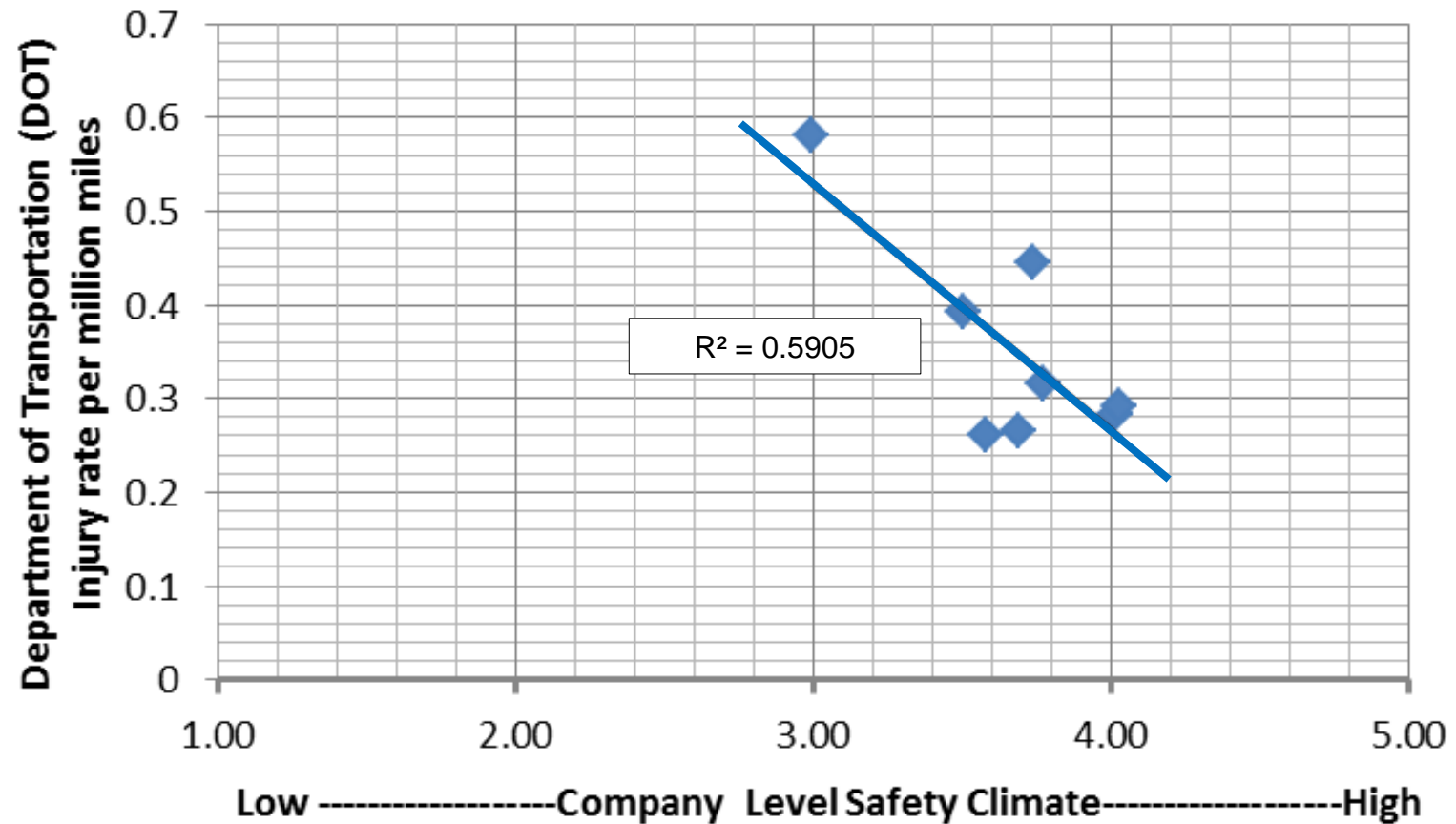
Data collected:

- **Subjective:** SC and self-reported behaviors
- **Objective:** accident/injury data (6 mo and 3 yrs post survey)

Company	A	B	C	D	E	F	G	H
# Respondents	558	248	2,030	461	290	4,003	235	270
Response Rate	55%	73%	34%	37%	58%	51%	40%	N/A

- 8 Large trucking firms in the US
- 9,095 respondents (8095 employees, 1,000 supervisors)
- Final SC survey includes 40 items (20 Group-level, 20 Company-level Safety Climate)

Injury Rate versus Safety Climate Score for Participating Carriers



SC in the Utility Industry

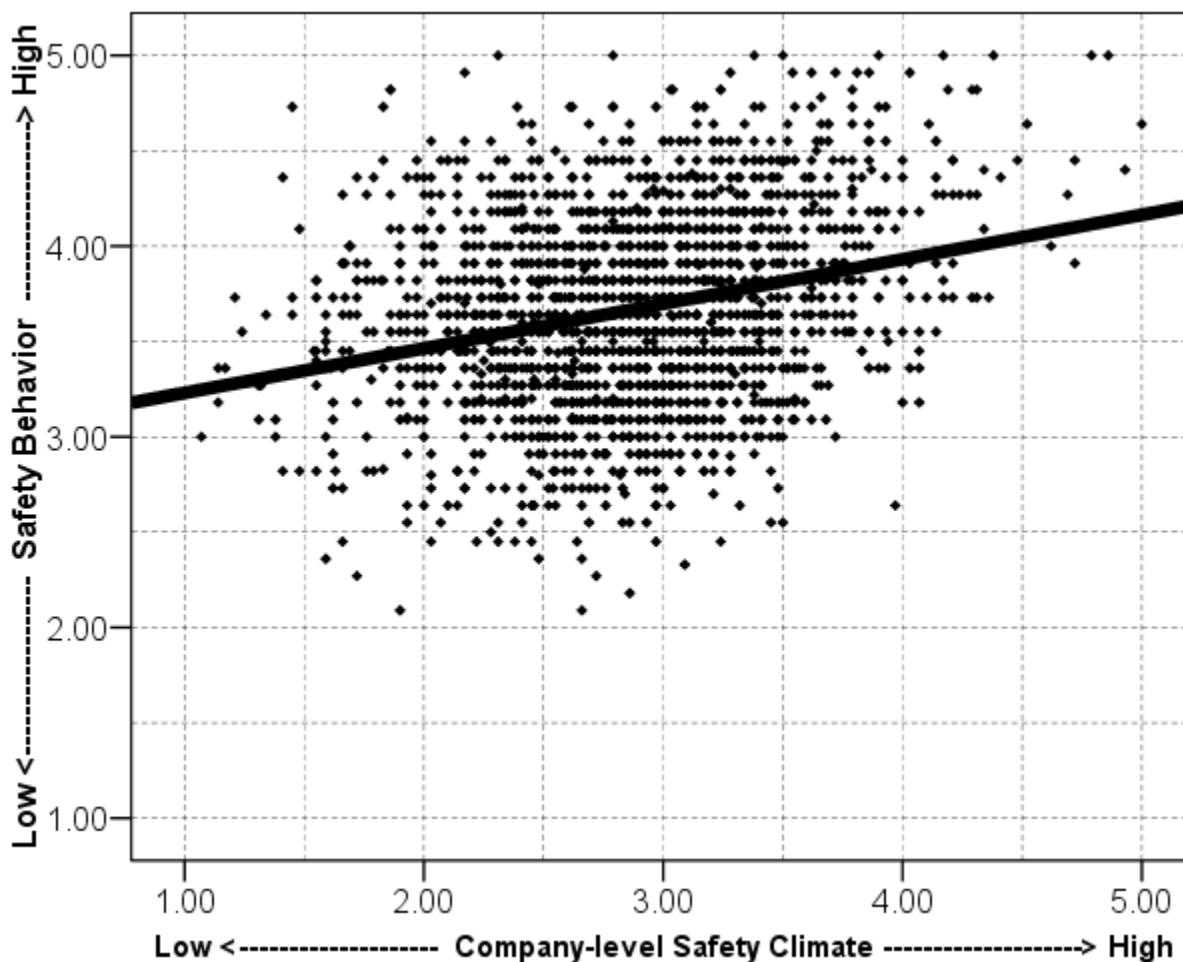
Data collected:

- **Subjective:** SC, self-reported behaviors, self-reported accident/injuries
- **Objective:** Group-level accident/injury data

Company	A	B
# Respondents	1,560	869
Response Rate	46%	74%

- Two large electric utility firms
- 2,421 respondents
- 48 item survey (19 Group-level, 29 Company-level)

SC and Safety Behavior for Utility Workers



Key Findings

- **Generic scales** and **industry-specific scales** are reliable and valid instruments for measuring SC in lone workers (true for both trucking and utility workers)
- Both generic and industry-specific scales predicted driving safety behavior (self-reported) and road injury outcomes (accident data)
- The industry-specific safety climate scale demonstrated stronger predictive value than the generic scale (data only available for trucking)

Scale Attributes

- Measurement equivalence for the 12-point **generic scale** confirmed strong external validity across 3 industries, 11 companies (including third industry with remote workers)
- The trucking **industry-specific safety climate scale** items and measurement constructs have consistent meaning across different trucking companies

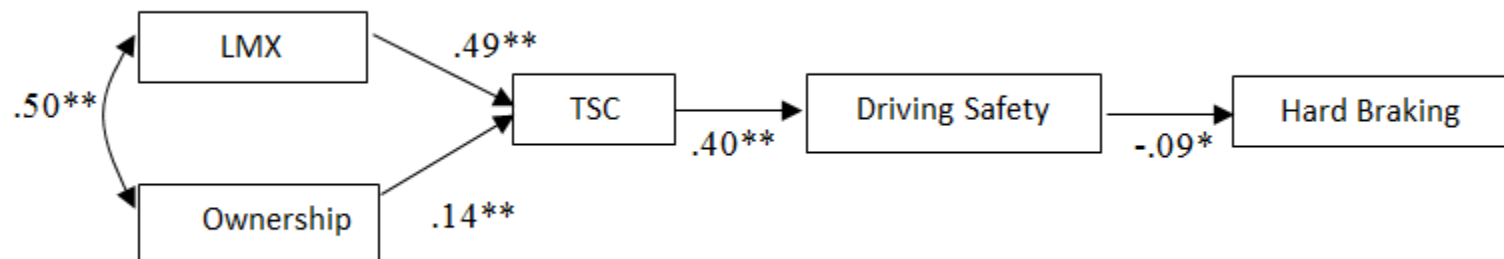
Employee vs. Supervisors' Perceptions

(Trucking and Utility Industries)

- For both company- and group-level safety climate, employee and supervisor perceptions of safety climate were significantly different
 - supervisors consistently reported higher levels of safety climate
- Only employee perceptions of safety climate significantly predicted safety behavior (directly) and injury outcomes (indirectly)
 - supervisor perceptions had no predictive value

Leaders Create Culture

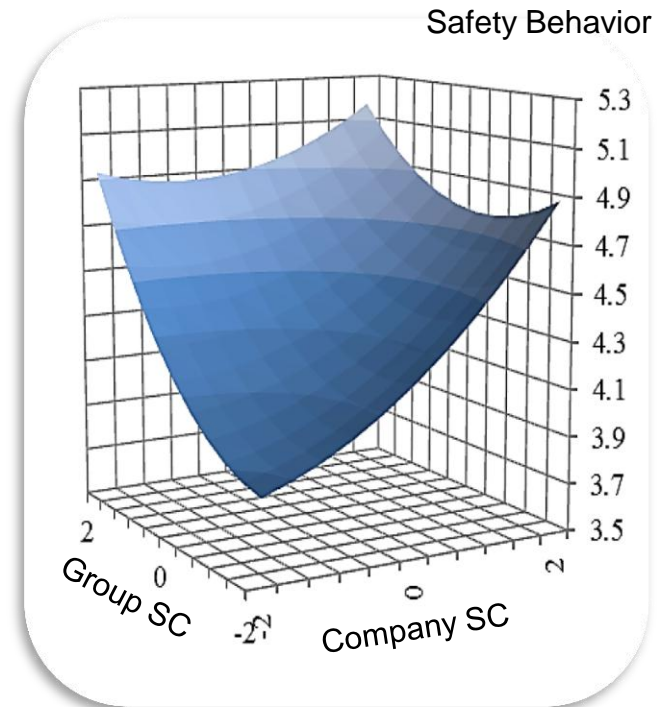
Testing the role of contextual factors of lone work known from the management science literature



Leader-Member Exchange (LMX) and Work Ownership both promote safety climate

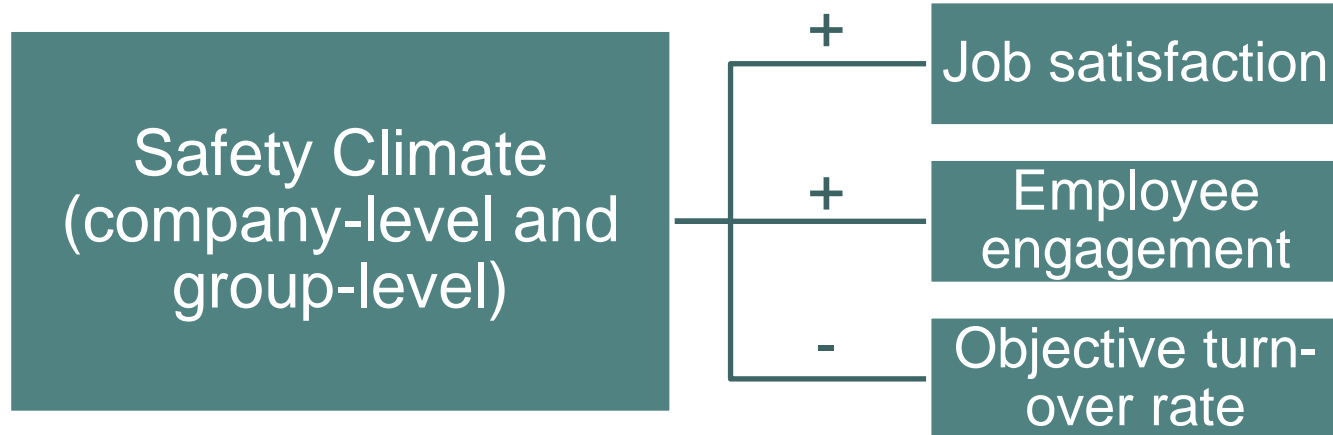
Interaction Between Group and Organization Safety Climate

- The highest levels of safety behavior occur when both Company-level SC and Group-level SC are high
- If either Group-level or Company-level SC is high, the overall impact on Safety Behavior for lone workers is good
- Supervisors with high commitment to safety are critical, especially for companies with low Company-level SC



Safety Climate Affects Work Quality

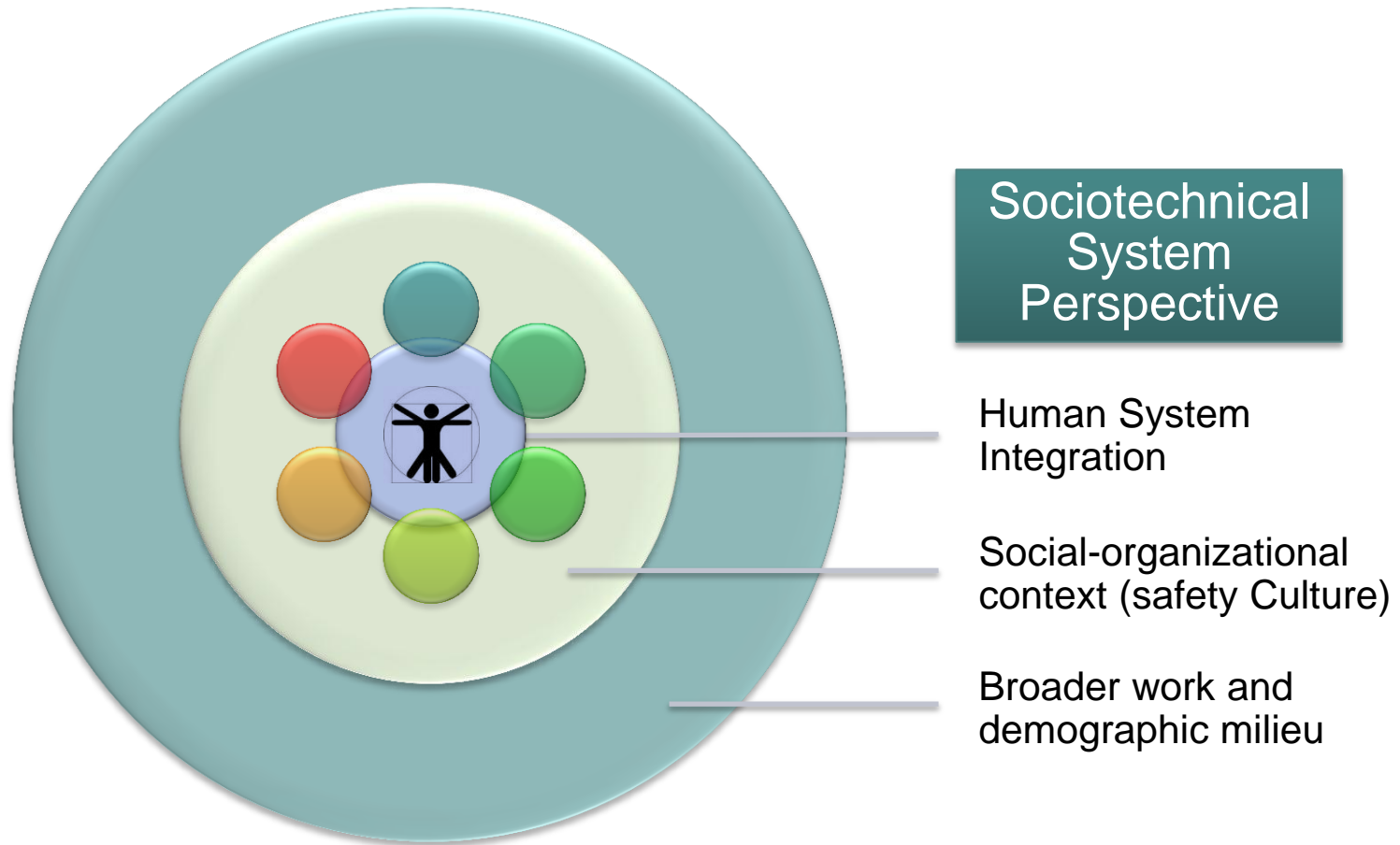
- Company-level and Group-level safety climate perceptions directly influence job satisfaction, employee engagement, and objective turnover rate (3 years after survey).



Towards Evidence-Based Interventions

- Safety climate is a valid thermometer across diverse settings and applications
- While predictive of outcomes, and able to discriminate good from bad organizations, SC is not diagnostic
- Intervention requires systematic evaluation to identify system weak points
- For complex systems, other indicators (surveillance, probes, tests, etc.) may be required to guard against “drift into failure”
 - Complex sociotechnical systems are dynamic and non-linear and may require continuous adaptation

Safety as an Emergent Property



The Future

- Exploring the intersection between safety climate, resilience engineering and management science
- Developing interventions based on SC screening followed by comprehensive analysis guided by sociotechnical systems theory

References

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